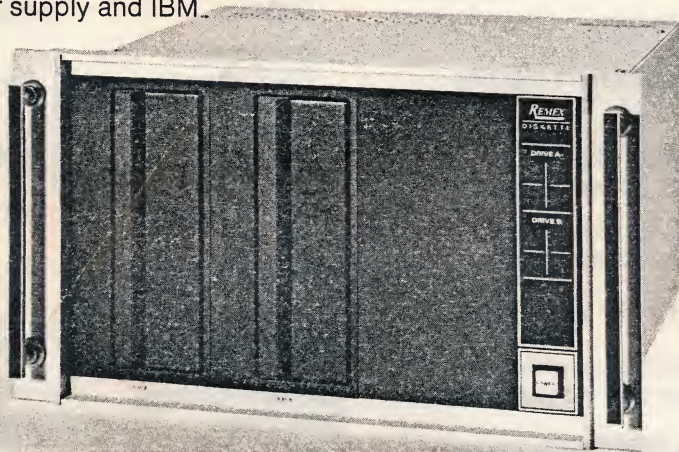


# FLEXIBLE DISK SYSTEMS

The RFS 7400 is the most versatile flexible disk system available for storage and retrieval of data with PDP-11, PDP-8/E and Nova minicomputers. This IBM compatible system provides mass data storage with extremely fast throughput and optimum data reliability for a wide variety of applications. The basic system includes from one to four RFD 7400 disk drives, a power supply, cables and formatter electronics in a desk top or 19" rack enclosure. In IBM 3740 format, data capacity is 1.9 Mbits of data per drive or 7.6 Mbits total capacity in a four drive system. Media used are standard, unaltered IBM or equivalent diskettes. In addition to the outstanding high performance characteristics of the incorporated drives, the RFS 7400 features "overlap seek" which allows four drives to be stepped simultaneously to new tracks.

The RFS 7400 Flexible Disk Systems are available in four basic configurations:

- Single drive with power supply and IBM compatible formatter
- Dual drive with power supply and IBM compatible formatter
- Single drive expander with power supply
- Dual drive expander with power supply



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# THE RIGHT FLEXIBLE DISK SYSTEMS

## OPTIONS

Optional hardware and software packages which increase the versatility of the system include:

- Universal Formatter providing selectable, soft sector formats
- IBM diskette initializer
- DMA and/or Programmed I/O Interface Controller
- "Three level" software packages including complete operating system, enhanced I/O package, driver and diagnostics

## SPECIFICATIONS

### System:

Data Capacity:	1.92 Mbits/diskette; 7.6 Mbits/4 drive system
Transfer Rate:	250 Kbits/sec.
Media Required:	IBM or equivalent diskette
Power Requirements:	110 VAC $\pm$ 10%, 60 Hz $\pm$ 0.5 Hz, 2.4 amps max. 230 VAC $\pm$ 10%, 50 Hz $\pm$ 0.5 Hz, 1.2 amps max.
Size:	10½" H x 19" W x 18" D
Weight:	60 pounds (dual drive w/ formatter and power supply)
Temperature:	40°F to 100°F with media (operating)
Relative Humidity:	20% to 80% without condensation (operating)

### Drive:

Data Capacity:	
IBM Initialized Diskette	1.94 x 10 <sup>6</sup> bits
Unformatted, Two Frequency Encoding	3.2 x 10 <sup>6</sup> bits
Bit Density (Inner Track):	3268 BPI
Rotational Speed:	360 RPM $\pm$ 2%
Average Latency:	83.3 ms
Access Time (track to track):	6 ms
Random Average Seek Time:	176 ms
Maximum Seek Time:	480 ms
Reliability:	
Recoverable Read Error Rate	less than 1 x 10 <sup>9</sup>
Positioning System	12 yrs. or 3.2 x 10 <sup>9</sup> steps
Head Life	more than 15,000 hours
Media Life	5 million passes per track of approved media

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**Peripheral  
Products**

EX-CELL-O CORPORATION

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Bulletin No. ED2-549/503

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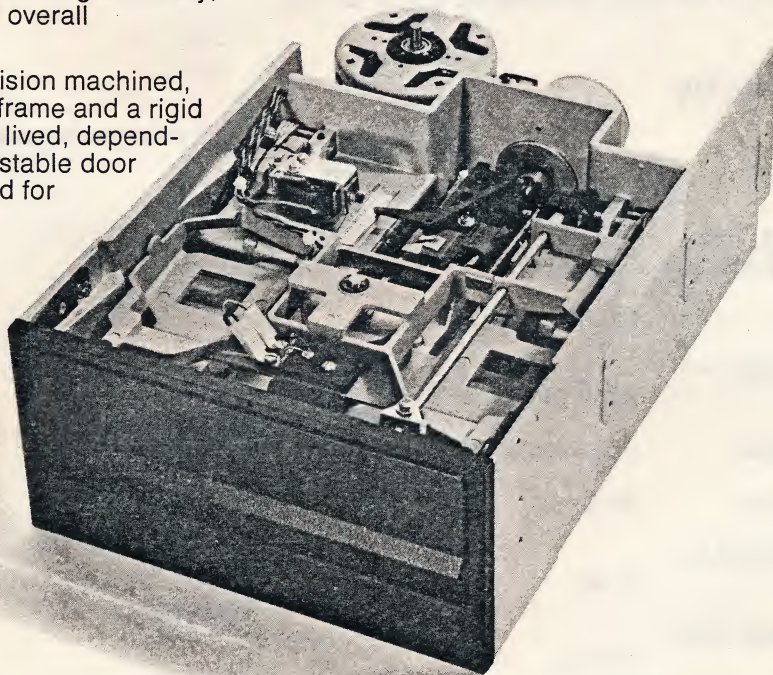
# FLEXIBLE DISK DRIVES

## RFD 7400 SERIES

The RFD 7400 is an IBM compatible, direct access memory device providing 1.9 Mbits of data storage and retrieval in IBM format, or 3.2 Mbits unformatted, at a data transfer rate of 250 bps. Total IBM compatibility is achieved by means of identical read/write/erase head geometry, head positioning to meet precise track location requirements, equivalent recording levels and compatible bit packing densities in all tracks. Options to the drive are available to increase data storage with non-IBM compatible formats. Standard, unaltered IBM diskettes or equivalent media are used in all configurations.

The unit provides fast throughput of data with unequaled data reliability — assured through gentle media handling, head positioning accuracy, superior read/write circuitry and overall mechanical design.

This fully tooled drive has a precision machined, single piece, die cast aluminum frame and a rigid cast, carrier mechanism for long lived, dependable operation. A wide mouth, bistable door facilitates loading. It is configured for stacking and easy mounting in a 19" rack.



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# THE RIGHT FLEXIBLE DISK DRIVES

## RFD 7400 SERIES

### OPTIONS

For complete flexibility in OEM system design, the RFD 7400 is available with the following standard options:

- Sector Generator — to increase storage capacity by means of hard sectoring
- Data Separator — to provide separate data and clock pulses at the interface
- Write Enable Switch — for protection of data
- Operator Interlock — to assure proper diskette placement
- Ceramic Head — for extended head and media life
- Unit Select — for daisy chaining up to four drives

### SPECIFICATIONS

#### Capacity:

IBM Initialized Diskette	1.94 x 10 <sup>6</sup> bits
Unformatted, Two Frequency Encoding	3.2 x 10 <sup>6</sup> bits

Transfer Rate: 250 Kilobits/sec.

Bit Density (Inner Track): 3268 BPI

Rotational Speed: 360 RPM  $\pm$  2%

Average Latency: 83.3 ms

Access Time (track to track): 6 ms

Random Average Seek Time: 176 ms

Maximum Seek Time: 480 ms

#### Power Requirements:

AC Voltage Requirements  
(one of the following)

100 VAC $\pm$ 10%, 50/60Hz $\pm$ 0.5Hz @ 0.6A
110 VAC $\pm$ 10%, 50/60Hz $\pm$ 0.5Hz @ 0.6A
208 VAC $\pm$ 10%, 50/60Hz $\pm$ 0.5Hz @ 0.3A
230 VAC $\pm$ 10%, 60Hz $\pm$ 0.5Hz @ 0.3A

#### DC Voltage Requirements

+5 VDC $\pm$ 5% @ 740 ma
-12 VDC $\pm$ 10% @ 100 ma
+24 VDC $\pm$ 10% @ 1.5A stepping, 0.75A standby

#### Power Dissipation, Maximum

DC: 25 Watts plus 25 Watts additional during seeking
AC: 45 Watts

Temperature: 40°F to 100°F with media (operating)

Relative Humidity: 20% to 80% without condensation (operating)

Weight: 15 pounds

#### Reliability:

Recoverable Read Error Rate	less than 1 x 10 <sup>9</sup>
Positioning System	12 yrs. or 3.2 x 10 <sup>9</sup> steps
Head Life	more than 15,000 hours
Media Life	5 million passes per track of approved media

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# FLEXIBLE DISK DRIVES

Data Sheet

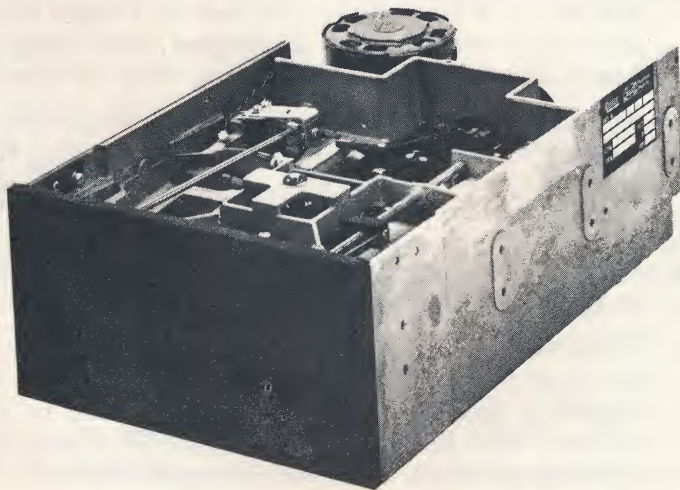
RFD 1000

Specifications and Interface

The RFD 1000 is an IBM compatible, random access memory device providing 1.9 Mbits of data storage and retrieval in IBM format, or 3.2 Mbits unformatted single density or 6.4 Mbits unformatted double density. Total IBM compatibility is achieved by means of identical read/write/erase head geometry, head positioning to meet precise track location requirements, equivalent recording levels and compatible bit packing densities in all tracks. Standard, unaltered IBM diskettes or equivalent media or 33 hole hard sector media may be used in all configurations.

The unit provides fast throughput of data with unequalled data reliability — assured through gentle media handling, head positioning accuracy, superior read/write circuitry and overall mechanical design.

Designed and manufactured by REMEX, the RFD 1000 is carefully monitored by rigid quality standards throughout each step of assembly and test. This fully tooled drive has a precision machined, single piece, die cast aluminum frame and a rigid die cast carrier mechanism for long lived, dependable operation. A wide mouth, bistable door facilitates loading. It is configured for stacking and easy mounting in a 19" rack.



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RFD 1000



## RFD 1000 FEATURES

The RFD 1000 is available in two basic configurations each with additional options. Model RFD 1000A is the basic drive. A full feature version, the RFD 1000B is identical to the RFD 1000A but contains many additional features required in certain applications. Table 4, page 6 gives the complete model numbers and designations. For convenience, the following list of features is divided first into the basic RFD 1000A, secondly the RFD 1000B and third the options are available on both models.

### RFD 1000A FEATURES

- Compatibility with the IBM 3740 data entry system, the IBM 3540 diskette I/O unit and the IBM system 32. Read/write/erase head geometry is identical to that in IBM diskette drives and the mechanism for positioning the head meets the precise requirements of track location, thereby allowing complete diskette interchangeability.
- For applications where IBM format compatibility is not a requirement, storage capacity may be increased by the use of hard-sectored diskettes or double density encoding. The drive employs specially designed electronics which allows data capacity of twice that used with single density recording techniques.
- Unit select code decoding circuitry which allows the address code of an individual drive to be selected by simply setting the drive code switches. This feature eliminates the unit select decode circuitry from the host system and makes it possible for the user to change the drive address without physically removing the drives and interchanging them. Unit select and Ready line features allow bussing of up to four drives on a ribbon cable.
- Reduced power consumption because an at-rest voltage of only 5 volts is applied to the stepper motor. When stepping from track to track a short duration 24 volt pulse is applied to ensure rapid response and cooler operation.
- Automatic erase control eliminates the need for erase gate electronics in the host system.
- Diskette media protection is provided by a mechanical interlock which prevents door closure when the diskette media is not properly inserted. In addition, gentle media handling is assured by an expandable clutching system. Extended head and media life is assured by using a ceramic head included in every drive as a standard feature. A busy indicator, installed on the front panel, is lit when the head is loaded.

### RFD 1000B FEATURES

In addition to those listed above for the RFD 1000A, the following additional features are contained on the RFD 1000B:

- An index/sector separator circuit which provides 32 sector pulses per revolution when 33-hole hard sector diskettes are used. (When this feature is not equipped, the Index output will transmit both the sector and index pulses.)
- File safety is enhanced by an error flag circuit which transmits a FILE UNSAFE signal to the host equipment if:
  - a. Write Gate is active and there is a lapse or break in data line activity during a write operation.
  - b. Both Write Gate and Write Protect active.
  - c. An attempt is made to write within 50 milliseconds after the head-load signal is given or when the head is not loaded.



## RFD 1000 FEATURES (Continued)

- d. The drive is signaled to step from track to track while writing.
- e. An attempt to write when there is no rotating diskette in the drive.
- Without having to address the drive, the host system is provided continuous non-bussed status signals through a separate connector with following functions: SECTOR, INDEX, READY and HEAD LOAD.
- A Data Separator circuit provides Data and Clock pulses on separate lines (single density applications only).

### OPTIONS

The following options are available on either the RFD 1000A or RFD 1000B:

- Optical Write Protect sensor disables write circuitry when a notch is uncovered on a write protected diskette.
- A variable negative voltage option which allows the customer to input a DC voltage of between -7V and -16 Vdc when the required -5 Vdc supply is not available.
- A door lock mechanism is available which prevents the manual opening of the door when the head is loaded.

Table 1. Modes of Operation

Operational Mode	Description
POWER UP	AC and DC power can be applied in any sequence. Once AC power is applied, a two second delay must be completed before any Read or Write Operation is attempted. When DC power is applied, a 50 milli-second power on reset automatically resets the electronics and inhibits inadvertent writing or erasing. To insure proper positioning of the R/W head prior to the first read or write operation, a Step Out operation should be performed until the Track 00 indicator becomes active.
SEEK	Positions the read/write head to the desired track for recording or retrieving data. Seeking is prohibited during write mode and will result in the following sequence: (1) setting of File Unsafe, (2) deactivation of Write and (3) stepping. The drive will not step further out than track 00.
WRITE	Records data in the form of flux reversals. Write safety circuits are provided to ensure that hardware failure or operator interface does not cause loss of data. If write safety circuits detect a file unsafe condition, a latch is set, writing is inhibited and the host system notified via the File Unsafe line. File unsafe conditions are defined as an active Write Gate and one or more of the following: (1) no write data, (2) Write Protect Active (Write Protect Option only), (3) Step also present, (4) head not loaded and (5) media not in.
READ	Retrieves data previously recorded by sensing flux reversals on the diskette. Read mode is entered if a diskette is present and the door is closed by activating the Load Head line and ensuring the Write Gate line is inactive. In model RFD1000B, data is available at the output in both composite form and as separate data and clock (single density recording only).
POWER DOWN	When the +5 Vdc drops below +3.5 Vdc, all write circuitry is deactivated to prevent inadvertent writing or erasing.



# Table 2. Specifications

Capacity/Disk  
 1.94 x 10<sup>6</sup> Bits, IBM Initialized Diskette  
 3.2 x 10<sup>6</sup> Bits, Unformatted, Two Frequency Encoding, Single density  
 6.4 x 10<sup>6</sup> Bits, unformatted MFM double density

Capacity/Track  
 26,624 Bits, IBM Initialized Diskette  
 41,666 Bits, Unformatted, Two Frequency Encoding, Single density  
 83,332 Bits, Unformatted, MFM double density

Transfer Rate: 250 Kilobits/sec.

Recording Density: Single Density

Outer Track - 1836 BPI  
 Inner Track - 3268 BPI

Double Density

Outer Track - 3672 BPI  
 Inner Track - 6536 BPI

Rotational Speed: 360 RPM ± 2.5%

Average Latency: 83.3 ms.

Access Time:  
 6 ms Track to Track  
 24 ms settle  
 176 ms Random Access  
 480 ms Maximum Access

Head Load Time: 50 ms

Number of Tracks: 77

Variations affecting the electronics or packaging are also available on a special basis.

Track Spacing: 48 Tracks/Inch

Temperature

Operating: 50°F to 100°F with media  
 Storage: -30°F to 150°F without media

Humidity

Operating: 20 to 80% without condensation  
 Storage: 5% to 98% without condensation

AC Power Requirements (one of the following)

100 or 115 VAC @10%, 50/60 Hz ± 0.5 Hz @ 0.75A  
 200, 220 or 240 VAC ± 10%, 50/60 Hz ± 0.5 Hz @ 0.4A

DC Power Requirement

+5 Vdc ± 5% @ 1.5A  
 +24 Vdc ± 5% @ 1.5A Stepping; 0.35A Standby  
 -5 Vdc ± 5% @ 0.2A (Optional: -7Vdc to -16Vdc adjustable)

Nominal Heat Dissipation: 320 BTU/Hr.

Weight: 15 lbs.

Reliability

Recoverable Read Error Rate:

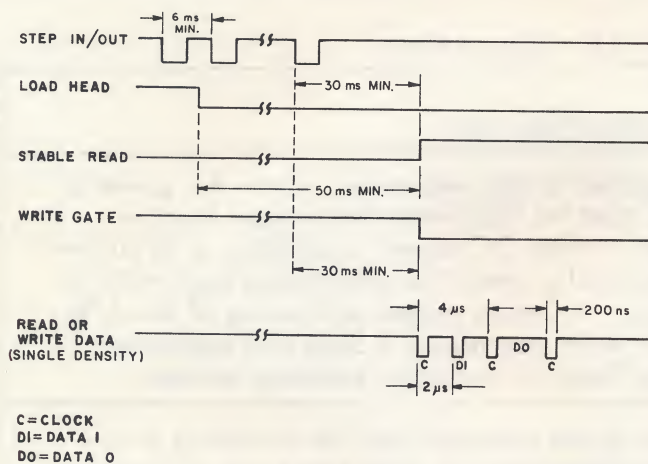
Less than 1 in 10<sup>9</sup> bits

Unrecoverable Read Error Rate:

Less than 1 in 10<sup>12</sup> bits

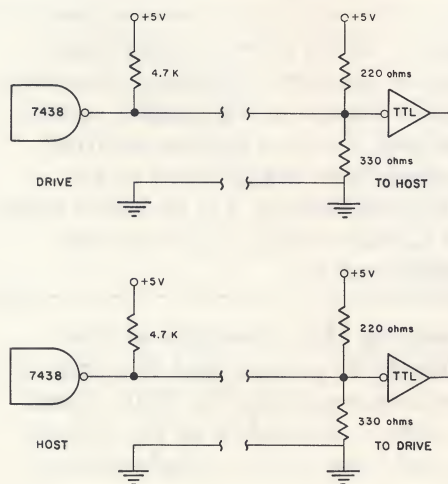
Head Life: More than 30,000 hours

Media Life: More than 5 x 10<sup>6</sup> passes per track on approved media.



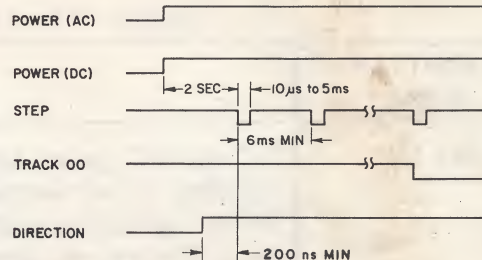
MMC 577

## Read/Write Timing



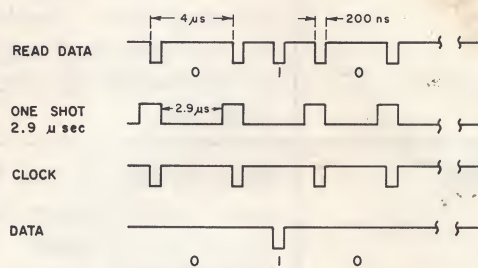
MMC 416

## Interface Circuitry



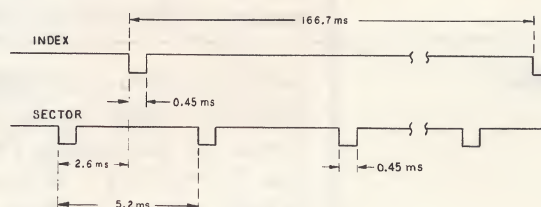
MMC 520

## Power Up and Step Sequence



MMC 425

## Data Separator Timing ①



MMC 583

## 32 Sector/Index Timing ① Model RFD1000B Only.



Table 3. Interface Signal Descriptions

Connector Pin	Description															
J1-1, 2 J1-39, 40	Drive Address A*(pin 1) and Drive Address B* (pin 39) input. These lines define one of four drives selected for communication with the host system as follows: <table><tr><th>Pin 1</th><th>Pin 39</th><th>Selected Drive</th></tr><tr><td>Inactive</td><td>Inactive</td><td>Drive 0</td></tr><tr><td>Active</td><td>Inactive</td><td>Drive 1</td></tr><tr><td>Inactive</td><td>Active</td><td>Drive 2</td></tr><tr><td>Active</td><td>Active</td><td>Drive 3</td></tr></table>	Pin 1	Pin 39	Selected Drive	Inactive	Inactive	Drive 0	Active	Inactive	Drive 1	Inactive	Active	Drive 2	Active	Active	Drive 3
Pin 1	Pin 39	Selected Drive														
Inactive	Inactive	Drive 0														
Active	Inactive	Drive 1														
Inactive	Active	Drive 2														
Active	Active	Drive 3														
J1-3, 4	Not assigned.															
J1-5, 6	Read Data (Composite)* Output. Each flux reversal causes a transition from the high inactive level to the low active level for a period of 200 ±30 nanoseconds. Data output to the host system is in the same form as the write data received from the host system.															
J1-7, 8	Ready* Output. A low active level indicates that a diskette is loaded and rotating and that the front door is closed.															
J1-9, 10	Sector* Output. (RFD1000B Only). This signal is provided when a 33-hole diskette is used. A transition from the high inactive level to the low active level for a period of 0.45 ±0.2 ms occurs 32 times per revolution (5.2 millisecond nominal period).															
J1-11, 12	Index* Output. This signal is provided once each revolution (166.67 ms). Each logic transition from the high inactive level to the low active level indicates the beginning of the track (active for 0.45 ±0.2 msec). On Model RFD1000A, when a 33-hole diskette is used, this line will provide a pulse for each index and sector on the media.															
J1-13, 14	Write Data* Input. This line provides the composite clock and data from the host system to be written on the diskette. 0V pulses 200 nanoseconds wide are applied for each flux reversal to be written. Each transition from the high inactive level to the low active level reverses the write current through the write coils.															
J1-15, 16	Not assigned.															
J1-17, 18	Write Gate* Input. A low active level enables the write current source.															
J1-19, 20	File Unsafe* Output (RFD1000B only). A low active level indicates that a condition which may jeopardize data integrity has occurred. File Unsafe is reset by activating the File Unsafe Reset line (J1-25).															
J1-21, 22	Write Protect * Output (Option). A low active level occurs when a write protected diskette with an uncovered notch is inserted and indicates that the Write circuitry has been disabled. A high level indicates that a diskette with a covered Write protect notch or a diskette with no notch has been inserted and writing may occur.															
J1-23, 24	Track 00* Output. A low active level indicates that the read/write head is positioned at track 00.															
J1-25, 26	File Unsafe Reset* Input (RFD1000B only). A low active level (200 nanoseconds, min.) resets the File Unsafe Latch. This provides the capability of a write retry operation without the need for operator intervention.															
J1-27, 28	Low Current* Input. A low active level is required when writing on tracks 44 through 76. This input lowers the write current 20% which improves the read output resolution of the inner tracks.															
J1-29, 30	Step* Input. A low active (10 µsec min.) causes the read/write head to be moved one track. The direction of movement is controlled by the direction select line. The state of the direction select line must be stable 200 nanoseconds before the leading edge of step and must remain stable 200 nanoseconds after the leading edge of step.															
J1-31, 32	Direction (In*) Input. A low active level causes the read/write head to move towards the center of the disk when the step line (J1-29) is pulsed. A high inactive level and a pulse on the step line cause the head to move away from the center of the disk. The state of this input line must not change while step is active.															
J1-33, 34	Load Head* Input. A low active level causes the storage element to be placed in close proximity to the read/write head for data recording or retrieval. This line must be activated at least 50 ms before a read or write operation. The head is automatically unloaded when the door is opened and will not load unless a diskette is present, the door is closed and the medium is rotating.															
J1-35, 36	Separate Clock* Output. (RFD1000B only). This line provides the clock signal which has been separated out of data (J1-5). This signal is low active for 200 ±20 nanoseconds for each clock pulse. Used with single density recorded data only.															
J1-37, 38	Separate Data* Output. (RFD1000B only). This line provides the data signal which has been separated out of the composite read data (J1-5). This signal is low active for 200 ±30 nanoseconds for each data 1 (one) pulse. Used with single density recorded data only.															
J1-41 - 50	Not assigned. Key slot between pins 43 and 45.															

① Odd number pins are used for signals described; even number pins are used for return lines (except 42, 46, 48 and 50).  
The following connector J2 is present only on RFD1000B.

J2-1	*Head Load* (Non-Bussed) Input. This signal is identical to that used at J1-33 except that it allows the head to be loaded without addressing the drive.
J2-3	Index* (Non-Bussed) Output. This signal is identical to that appearing at J1-11 except that it is available continuously without selecting the drive. It may be used to enhance bussed operation by maintaining a current index position.
J2-5	Sector* (Non-Bussed) Output. This signal is identical to that appearing at J1-9 except that it is available continuously without selecting the drive. It may be used to enhance bussed operation by maintaining a current sector count.
J2-7	Ready* (Non-Bussed) Output. This signal is identical to that appearing at J1-7 except that it is available continuously without selecting the drive. It may be used to enhance bussed operation by maintaining current ready conditions for each drive.
J2-9	Spare

All even number pins J2-2 through J2-6 are designated as return lines for the adjacent signal.

J3-1	-5V
J3-2	Key
J3-3	+24V
J3-4	+24V Return
J3-5	+5V
J3-6	+5V return

Each input line has the following characteristics:

Active: 0V to 0.4V  
Inactive: +2.5V to +5.5V  
Input Impedance: 220 ohms to +5V  
330 ohms to GND

\*Signal title designated with asterisk (\*) denotes 0V active.

Each output line has the following characteristics:

Active: 0V to +0.4V  
Inactive: 4.7K ohms to +5V  
Minimum Sink: 47 ma.

Mating Connector Information for J1: Amp 88077-1  
Mating Connector for J2 is 3M Connector 3473.  
Mating Connector for J3 is Molex 09-50-7061 with 08-50-0106 contact.  
Mating Connector for AC Plug is Molex 19-09-1032 with 02-09-1104 contact (3 ea.).



# INSTALLATION DRAWING

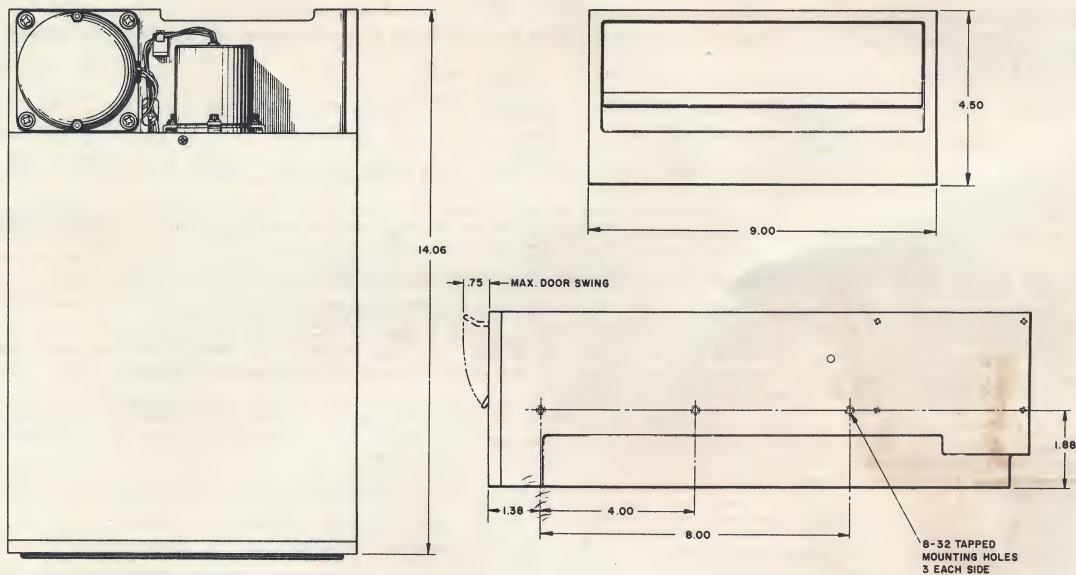


Table 4. How to Order

REMEX	FLEXIBLE DISC	DRIVE	MODEL SERIES	OPTIONS	RESERVED	MODEL CHANGE	THESE DIGITS NOT USED WITH DRIVE	INPUT VOLTAGE	SPECIAL NUMBER
R	F	D	1000	X	-	A (a)	/---/---/	X	XXX (b)

000 = Standard Unit  
9XX = Standard Unit with additional options.

Last two digits refer to number of additional options

A	Basic Drive
B	Basic Drive plus index/sector separator, file unsafe, data separator, non-bussed signal status.

S	115 VAC, 60 Hz
E	220 VAC, 50 Hz
J	100 VAC, 50 Hz
H	200 VAC, 50 Hz
A	240 VAC, 50 Hz

EXAMPLE  
RFD1000B-A/---/---E901

Full feature drive with 220 VAC, 50 Hz plus one additional option.

NOTES: (a) Letter changes with each model change.

(b) Assigned by REMEX. Digits 400 thru 899 denote a special drive.

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